

Development of load specifications for the design of the breeding blanket system

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Motivation

- List of all relevant single loads and load combinations
- Categorization of relevant load combinations
- Identification of the load combinations short list relevant to the Pre-Conceptual Design (PCD) phase

Load categories and damage levels

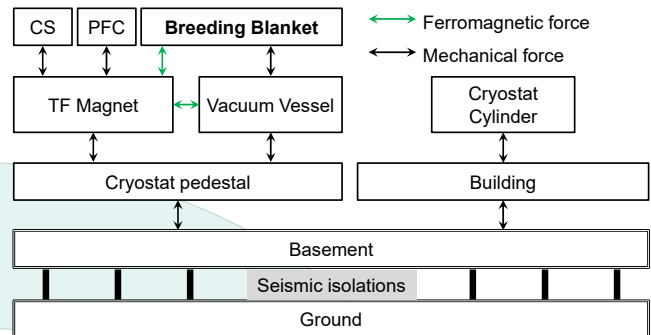
Loading Category	Damage Limit	Criteria Level
Category I: Operational Loading Conditions	Normal test	Level A
Category II: Likely Loading Conditions ($f > 10^{-2}/a$)	Upset	Level B
Category III: Unlikely Loading Conditions ($10^{-2}/a > f > 10^{-4}/a$)	Emergency	Level C
Category IV: Extremely Unlikely Loading Conditions ($10^{-4}/a > f > 10^{-6}/a$)	Faulted	Level D

- Criteria levels defined according to RCC-MRx
- Events, with lower occurrence frequency than the Cat- IV, are not considered within the design basis

Short list of load combinations for the HCPB and WCLL BB for the PCD phase

Cat.	DEMO Operat. State	Plasma state	Press./ Magn./ Seis.	Initiat. event	Concaten. event
I	POS	Normal cycle	-	-	-
I	POS	Fus. Power excursion	-	-	-
II	POS	MD II	-	MD II	-
II	POS	VDE II	-	VDE II	-
II	POS	MD I	SL-1	SL-1	MD I
III	POS	MD III	-	MD III	-
III	POS	VDE III	-	VDE III	-
IV	POS	Normal cycle	SL-2	SL-2	-
IV	POS	Normal cycle	-	-	Ex-Vessel LOCA
IV	POS	Normal cycle	-	In-Box LOCA	-

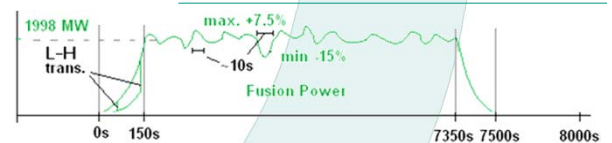
Path of the main loads



Single loads

Load	Type
Dead Weight	Inertial loads
Seismic	
State Test	Pressure loads
In-Vessel LOCA	
In-Box LOCA	
Ex-Vessel LOCA	Thermal loads
Normal operational	
Accidental events	EM loads
Off normal transients	
Plasma pulse	EM loads
Off-normal	

Breeding Blanket Load Specifications Document



Pressure and temperature loads in each state

Component	Fluid	Pressure test	Normal Operation	Design value
HCPB BB	FW + Helium	17.801 MPa	8.0 MPa	9.2 MPa
	BZ	20 °C	300 °C	550 °C
	PB Helium	0.445 MPa	0.2 MPa	0.23 MPa
WCLL BB	FW Water	25.570 MPa	15.5 MPa	17.825 MPa
	BZ Water	20 °C	295 °C	344.8 °C
	PbLi	0.742 MPa	0.45 MPa	0.5175 MPa
		20 °C	326 °C	344.8 °C